PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-159465

(43)Date of publication of application : 04.06.2002

(51)Int.CI. A61B 5/055
G01R 33/32
G01R 33/389

(21)Application number : 2000-350019

(22)Date of filing : 16.11.2000

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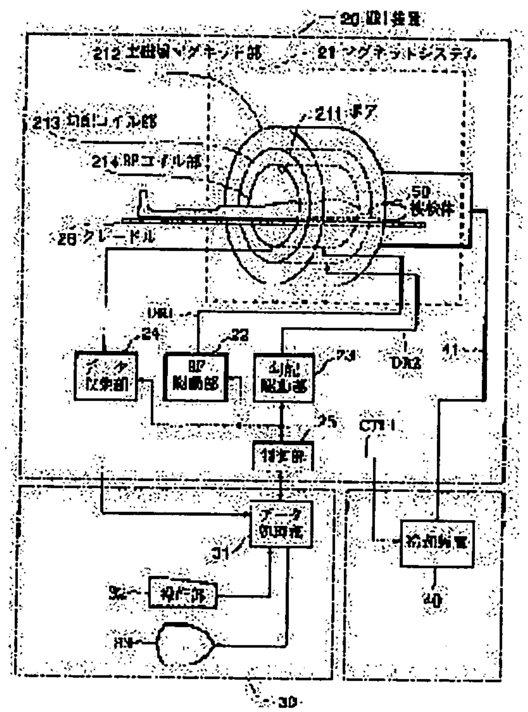
(54) MAGNETIC RESONANCE IMAGING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a magnetic resonance imaging apparatus which can set a driving power for cooling for every protocol with different number of times for repeating pulse sequences in one repetition time, or one TR, can prevent from producing images out of focus, and reduces power consumption and noise.

SOLUTION: A magnetic resonance imaging apparatus is equipped with the following parts: A control section 25 refers to a look-up table or computes automatically and produces a controlling signal CTL1 which directs to cool down a radio frequency coil, or a RF coil, 214 for every protocol with the most appropriate cooling capacity by a cooling system 40 without cooling it excessively when a data processing section 31 of an operator console 30 appoints a protocol to carry out. A cooling system 40 leads cooling air to a passage 41 for cooling air connected to the RF coil 214 with a cooling capacity which meets the direction of the controlling signals CTL1 by the control section 25.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing for explaining the layout of the magnetic resonance photography system which adopted the magnetic resonance photography equipment concerning this invention.
[Drawing 2] It is the block diagram showing the 1st operation gestalt of the MRI system concerning this invention.
[Drawing 3] It is drawing for explaining the example of an arrangement configuration of the main magnetic field magnet section in the magnet system concerning the operation gestalt of **** 1, the inclination coil section, the RF-coil section, and the path of the cooling style.
[Drawing 4] It is a timing chart for explaining the pulse sequence of spin echo.
[Drawing 5] It is drawing showing an example of the look-up table to which the tested part corresponding to the protocol concerning the operation gestalt of **** 1 which should be performed, and the refrigeration capacity corresponding to the RF coil which should be directed to a cooling system were set.
[Drawing 6] It is a flow chart for explaining actuation of the operation gestalt of **** 1.
[Drawing 7] It is the block diagram showing the 2nd operation gestalt of the MRI system concerning this invention.
[Drawing 8] It is drawing showing the example of an arrangement configuration of the main magnetic field magnet section in the magnet system concerning the operation gestalt of **** 2, the inclination coil section, the RF-coil section, and the path of the cooling style.
[Drawing 9] It is drawing showing an example of the look-up table to which the tested part corresponding to the protocol concerning the operation gestalt of **** 2 which should be performed, and the refrigeration capacity corresponding to the inclination coil which should be directed to a cooling system were set.
[Drawing 10] It is a flow chart for explaining actuation of the operation gestalt of **** 2.
[Drawing 11] It is the block diagram showing the 3rd operation gestalt of the MRI system concerning this invention.
[Drawing 12] It is drawing showing the example of an arrangement configuration of the main magnetic field magnet section in the magnet system concerning the operation gestalt of **** 4, the inclination coil section, the RF-coil section, and the path of the cooling style.
[Drawing 13] It is drawing showing an example of the look-up table to which the tested part corresponding to the protocol concerning the operation gestalt of **** 3 which should be performed, and the refrigeration capacity corresponding to the inclination coil which should be directed to a cooling system were set.
[Drawing 14] It is a flow chart for explaining actuation of the operation gestalt of **** 3.
[Drawing 15] It is the block diagram showing the 4th operation gestalt of the MRI system concerning this invention.
[Drawing 16] It is a flow chart for explaining actuation of the operation gestalt of **** 4.
[Drawing 17] It is drawing for the conventional technical problem to explain.
[Description of Notations]
10 -- An MRI system, 11 -- A scanning room, 12 -- Actuation room, 13 -- A machine room, 20 -- MRI equipment, 21 -- Magnet system, 211 -- A boa, 212 -- The main magnetic field magnet section, 213 -- Inclination coil section, 214 [-- Data collection section,] -- The RF-coil section, 22 -- RF mechanical component, 23 -- An inclination mechanical component, 24 25, 25A-25C [-- The data-processing section, 32 / -- A control unit, 33 / -- 40 A display, 40A / -- A cooling system, 41, 41A, 42 / -- The path of the cooling style, 50 / -- Analyte.] -- A control section, 26 -- A cradle, 30 -- An operator console, 31

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention holds analyte in static magnetic field space, collects data about the magnetic resonance photography equipment which photos the tested part of analyte using magnetic resonance by the pulse sequence (pulsesequence) which acquires a magnetic resonance signal to every 1 repetition time (TR;repetiton time) especially, and relates to the cooling system of the coil for magnetic field formation in the magnetic resonance photography equipment which reconfigurates an image based on the data, and its method.
[0002]
[Description of the Prior Art] In magnetic resonance photography processing, the spin (spin) in analyte is excited by the excitation pulse for every TR, and the magnetic resonance signals produced by it are collected to the two-dimensional Fourier space as a spin echo (sion echo) or a gradient echo (gradient echo). Phase encoding which is different in every so-called view (view) is given to a magnetic resonance signal, and the echo data of two or more views with which the locations on a phase shaft differ in the two-dimensional Fourier space is collected, respectively. And an image is reconfigurated by carrying out the two-dimensional inverse Fourier transform of the echo data of all the collected views.
[0003] In such magnetic resonance photography processing, the number of pulse sequences used for every TR changes with protocols set up by corresponding for every tested part. for example, a count according to tested parts, such as a head, a thorax, and an abdomen, which is different for every protocol, respectively -- for example, it is repeated 64 times to 512 times, and the viewdata of 512 views is acquired from 64 views.
[0004] The magnetic resonance photography equipment which performs such magnetic resonance photography processing has the magnet system which has the building envelope (boa) in which analyte is held. This magnet system has the RF coil which forms the RF magnetic field for exciting spin in analyte in the inclination coil which forms the gradient magnetic field for attaching inclination to the reinforcement of the static magnetic field which the main magnetic field magnet which forms a static magnetic field in a boa, and the main magnetic field magnet formed, and the static magnetic field space which the main magnetic field magnet formed.
[0005] And when performing magnetic resonance photography processing by the spin echo mentioned above, for example, in one pulse sequence, the gap which has 180-degree pulse for the 90 degree pulse and spin reversal which are an excitation pulse to an RF coil is set, and it is impressed. 90-degree excitation of spin is performed by the 90 degree pulse, and 180-degree excitation, i.e., spin reversal, is performed by 180-degree pulse. At this time, a slice gradient pulse is impressed to an inclination coil, respectively. Moreover, a lead-out gradient pulse and a phase encoding gradient pulse are impressed between 90-degree excitation and spin reversal at a period.
[0006] The RF coil with which the excitation pulse was impressed is the resonance frequency f0 expressed with the following formula (1) based on the inductance L of a coil, and the capacitance C of a capacitor. It has, and it oscillates and a RF magnetic field is formed in a boa.
[0007]
[Equation 1]
f0 =1/2pi(LC) 1/2 -- (1)
[0008] by the way, resonance frequency f0 of this (1) type pyrexia of the capacitor which had a positive temperature gradient in fact when current flowed to the RF coil although it was the frequency which should be obtained ideally -- that capacitance C -- C+delta C -- a drift -- carrying out -- as a result -- resonance frequency f0 As it is alike and curvilinear [in a formula (2) and drawing 17] ** shows, a drift is carried out to f0' (a drift is carried out to curvilinear ** from ideal curvilinear **). Namely, although a flip angle ideal as an excitation pulse is 90 degrees (or 180), it will be in a condition equivalent to being shifted, for example to 80 etc. degrees etc., and will be in the condition that the reconstruction image based on two or more collected viewdata faded on the whole.

[0009]
[Equation 2]
f0'=1/2pi(L (C+delta C)) 1/2 -- (2)
[0010] So, with magnetic resonance photography equipment, the cooling system by air cooling of an RF coil was introduced, the amount of drifts of the resonance frequency mentioned above was made small, and dotage of a reconstruction image is prevented.
[0011]
[Problem(s) to be Solved by the Invention] However, with conventional magnetic resonance photography equipment, the blast weight in the cooling system of an RF coil is set as the constant rate which can respond to the protocol with which the calorific value in an RF coil is effectually predicted that calorific value becomes large most irrespective of a protocol with many counts of a repeat of a large pulse sequence, and a protocol with few counts of a repeat of a pulse sequence with small calorific value. If it puts in another way, the blower will be driven to the abbreviation maximum irrespective of calorific value.
[0012] Therefore, with conventional magnetic resonance photography equipment, in a protocol with few counts of a repeat of a pulse sequence with small calorific value, too much cooling will be performed, and useless power consumption is caused, and disadvantageous profit that the noise becomes large is during operation. Moreover, when too much cooling is performed, as shown, for example in curvilinear [in drawing 17] **, and a formula (3), the capacitance C carries out a drift to C-delta C by pyrexia of a capacitor, and it is resonance frequency f0 as a result. As curvilinear [in a formula (3) and drawing 1] ** shows, a drift is carried out and a possibility that dotage of a reconstruction image may arise is in f0."

[0013]
[Equation 3]
f0'=1/2pi(L (C-delta C)) 1/2 -- (3)
[0014] In addition, also in an inclination coil, it generates heat by impression of various driving pulses, and the drift of resonance frequency as shown by the above-mentioned (2) formula may happen. When the drift of the resonance frequency of an inclination coil happens, a possibility that the so-called ghost may occur is in a reconstruction image. However, although cooling for an RF coil is performed with conventional magnetic resonance photography equipment, the present condition is that cooling for an inclination coil is not performed.
[0015] It is in offering the magnetic resonance photography equipment which not only the thing for which this invention is made in view of this situation, and the 1st purpose can set up the drive power for cooling for every protocol with which the counts of a repeat of the pulse sequence in 1TR differ, and can prevent generating of image dotage etc. but also reduction of power consumption and the noise can plan.

[0016] The 2nd purpose of this invention is to offer the magnetic resonance photography equipment which can prevent the drift of the resonance frequency by pyrexia of an inclination coil, and can prevent a ghost's generating in a reconstruction image.
[0017]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the 1st viewpoint of this invention It is magnetic resonance photography equipment which holds analyte in static magnetic field space, and photos a tested part of analyte using magnetic resonance. An RF coil which forms a magnetic field for excitation for exciting spin in the above-mentioned analyte in response to a driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand, with an RF-coil driving means which supplies the above-mentioned driving signal according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned RF coil it has a cooling means to cool the above-mentioned RF coil with refrigeration capacity according to a control signal, and a control means which outputs the above-mentioned control signal according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned cooling means.

[0018] Moreover, in the 1st viewpoint of this invention, the above-mentioned control means generates and outputs a protocol with few counts of a repeat of a pulse sequence for the above-mentioned control signal so that refrigeration capacity may be made low.
[0019] moreover, in the 2nd viewpoint of this invention for every protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ A storage means by which refrigeration capacity corresponding to prediction calorific value in the above-mentioned RF coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned RF-coil driving means and a control means. The above-mentioned control means The above-mentioned control signal is outputted to the above-mentioned cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.
[0020] Moreover, the 2nd viewpoint of this invention holds analyte in static magnetic field space, and forms a magnetic field for excitation in the static magnetic field space concerned. It is magnetic resonance photography equipment which photos a tested part of analyte using magnetic resonance. An inclination coil which forms a gradient magnetic field for attaching inclination to reinforcement of the above-mentioned static magnetic field in response to a driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand, with an inclination coil driving means which supplies the above-mentioned driving signal according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned inclination coil it has a cooling means to cool the above-mentioned inclination coil with refrigeration capacity according to a control signal, and a control means which outputs the above-mentioned control signal according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned cooling means.
[0021] Moreover, in the 2nd viewpoint of this invention, the above-mentioned control means generates and outputs a protocol with few counts of a repeat of a pulse sequence for the above-mentioned control signal so that refrigeration capacity may be made low.
[0022] moreover, in the 2nd viewpoint of this invention for every protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ A storage means by which refrigeration capacity corresponding to prediction calorific value in the above-mentioned inclination coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned inclination coil driving means and a control means. The above-mentioned control means The above-mentioned control signal is outputted to the above-mentioned cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.
[0023] Moreover, the 3rd viewpoint of this invention is magnetic resonance photography equipment which holds analyte in static magnetic field space, and photos a tested part of analyte using magnetic resonance. An RF coil which forms a magnetic field for excitation for exciting spin in the above-mentioned analyte in response to the 1st driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand, An inclination coil which forms a gradient magnetic field for attaching inclination to reinforcement of the above-mentioned static magnetic field in response to the 2nd driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand, with an RF-coil driving means which supplies the 1st driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned RF coil with an inclination coil driving means which supplies the 2nd driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned inclination coil The 1st cooling means which cools the above-mentioned RF coil with refrigeration capacity according to the 1st control signal, The 2nd cooling means which cools the above-mentioned inclination coil with refrigeration capacity according to the 2nd control signal, it has a control means which outputs the 1st

control signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to a cooling means of the above 1st, and outputs the 2nd control signal of the above to a cooling means of the above 2nd.
[0024] Moreover, in the 3rd viewpoint of this invention, the above-mentioned control means generates and outputs a protocol with few counts of a repeat of a pulse sequence for the 1st and 2nd control signals of the above so that refrigeration capacity may be made low.
[0025] moreover, in the 3rd viewpoint of this invention for every protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ A storage means by which refrigeration capacity corresponding to prediction calorific value in the above-mentioned RF coil and an inclination coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned RF-coil driving means, an inclination coil driving means, and a control means. The above-mentioned control means The 1st and 2nd control signals of the above are outputted to the above 1st and the 2nd cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.
[0026] Moreover, it is magnetic resonance photography equipment which holds analyte in static magnetic field space, and photos a tested part of analyte in the 4th viewpoint of this invention using magnetic resonance. An RF coil which forms a magnetic field for excitation for exciting spin in the above-mentioned analyte in response to the 1st driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand, An inclination coil which forms a gradient magnetic field for attaching inclination to reinforcement of the above-mentioned static magnetic field in response to the 2nd driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand, with an RF-coil driving means which supplies the 1st driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned RF coil with an inclination coil driving means which supplies the 2nd driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned inclination coil it has a cooling means to cool the above-mentioned RF coil with refrigeration capacity according to a control signal, and a control means which outputs the above-mentioned control signal according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned cooling means.
[0027] Moreover, in the 4th viewpoint of this invention, the above-mentioned control means generates and outputs a protocol with few counts of a repeat of a pulse sequence for the above-mentioned control signal so that refrigeration capacity may be made low.
[0028] moreover, in the 4th viewpoint of this invention for every protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ A storage means by which refrigeration capacity corresponding to prediction calorific value in the above-mentioned RF coil and an inclination coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned RF-coil driving means, an inclination coil driving means, and a control means. The above-mentioned control means The above-mentioned ********** is outputted to the above-mentioned cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.
[0029] Moreover, in the 4th viewpoint of this invention, in the above-mentioned protocol which carries out activation, when refrigeration capacity which calorific value in the above-mentioned RF coil and an inclination coil should differ and control differs, the above-mentioned control means outputs the above-mentioned control signal to the above-mentioned cooling means so that cooling may be performed [refrigeration capacity of the higher one] for ******.
[0030] According to this invention, a protocol according to a tested part is specified to a control means, for example. in a control means, a control signal according to a count of a repeat of a pulse sequence of a driving signal used with a specified protocol repeat within a time is generated, and a cooling means is

supplied. For example, in a control means, as what has small calorific value, a control signal is generated and a protocol with few counts of a repeat of a pulse sequence of a driving signal is outputted to a cooling means so that refrigeration capacity may be made low.
[0031] Refrigeration capacity corresponding to a protocol is beforehand set as a table (look-up table) memorized by storage means as refrigeration capacity corresponding to prediction calorific value in an RF coil according to activation or an inclination coil of for example, each protocol. In a control means, corresponding refrigeration capacity is recognized by referring to this table. Or calorific value is calculated based on height (strength) and width of face (time amount) of a sequence pulse which are generated within repetition time of a driving signal used for that protocol in a carrier beam control means in assignment of a protocol, and optimal refrigeration capacity is drawn from this calculated calorific value.
[0032] And an RF coil or an inclination coil is stabilized by optimal capacity with refrigeration capacity specified by a control signal with a cooling means, and it is cooled. Moreover, specified protocol information is transmitted to an RF-coil driving means and an inclination coil driving means, and a driving signal of a count of a pulse sequence repeat according to a specified protocol is supplied to an RF coil and an inclination coil. A gradient magnetic field for a magnetic field for excitation being formed in static magnetic field space, and attaching inclination to reinforcement of a static magnetic field by this, is formed, and spin is excited in analyte. And it is transmitted to a processor circuit by magnetic resonance through a receiver coil, and an image is reconfigurated.
[0033] Moreover, in a control means, when refrigeration capacity which calorific value in an RF coil and an inclination coil should differ and control in a protocol to perform when cooling an RF coil and an inclination coil with a common cooling means differs, a control signal is generated and refrigeration capacity of the higher one is outputted to a cooling means in ******, so that cooling may be performed.
[0034]
[Embodiment of the Invention] Hereafter, it relates with a drawing and the magnetic resonance photography system concerning the operation gestalt of this invention is explained.
[0035] Drawing for 1st operation gestalt drawing 1 to explain the layout of the magnetic resonance photography (MRI:Magnetic Resonance Imaging) system which adopted the magnetic resonance photography equipment concerning this invention, and drawing 2 are the block diagrams showing the 1st operation gestalt of the MRI system concerning this invention.
[0036] In the MRI system 10 concerning this operation gestalt, as shown in drawing 1 , MRI equipment 20 is arranged in the scanning room 11 in which the closed space which prevents **** of the radiation magnetic field from a magnet and penetration of a disturbance magnetic field was formed, and the operator console 30 which Operator OP operates is arranged in the actuation room 12 adjoined and prepared in the scanning room 11. Moreover, the actuation room 12 is adjoined, the machine room 13 is installed, and the cooling system 40 as a cooling means is arranged in this machine room 13. The scanning rule 11 and the actuation room 12 are divided with the wall 14, and the door 15 and the windowpane 16 are formed in the wall 14. Moreover, from the cooling system 40 arranged at the machine room 13, the path 41 of the cooling style which introduces a cooling wind is connected as opposed to the magnet system 21 of the MRI equipment 20 arranged at the scanning room 11.
[0037] Hereafter, order is explained later on about MRI equipment 20, an operator console 30, and a cooling system 40.
[0038] MRI equipment 20 is shown in drawing 2 -- as -- the magnet system 21, the RF mechanical component 22, the inclination mechanical component 23, the data collection section 24, and a control section 25 -- and it has cradle 26.
[0039] As shown in drawing 2 , the magnet system 21 has the cylinder-like building envelope (boa: bore) 211 in general, and is carried in in a boa 211 by the conveyance section which the cradle 26 which carried analyte 50 through the cushion does not illustrate.
[0040] As shown in the magnet system 21 at drawing 2 , the main magnetic field magnet section 212, the inclination coil section 213, and the RF-coil section 214 are arranged around the magnet center in a boa 211 (center position to scan).

[0041] Each of the main magnetic field magnet section 212, the inclination coil section 213, and the RF-coil section 214 consists of one pair of coils which counter across the space in the boa 211 with which analyte 50 is located at the time of inspection.
[0042] Drawing 3 is drawing for explaining the example of an arrangement configuration of the main magnetic field magnet section 212 in the magnet system 21 concerning this operation gestalt, the inclination coil section 213, and the RF-coil section 214.
[0043] As the magnet system 21 is shown in drawing 3 , the top yoke 215 and the bottom yoke 216 are arranged so that it may counter through Space S (boa 211), and the top yoke 215 and the bottom yoke 216 are connected by the side yoke 217. The main magnetic field magnets 212a and 212b which constitute the main magnetic field magnet section 212 are formed in each field where the top yoke 215 and the bottom yoke 216 have countered. And the magnetic circuit which generates a static magnetic field in a boa 211 with the top yoke 215, the bottom yoke 216, the side yoke 217, and the one main magnetic field magnets 212a and 212b is formed.
[0044] Thus, the main magnetic field magnet section 212 forms a static magnetic field in a boa 211. The direction of a static magnetic field is parallel to the direction of a body axis of analyte 50 in general, for example. That is, an parallel magnetic field is formed. The main magnetic field magnets 212a and 212b which constitute the main magnetic field magnet section 212 are constituted using for example, a superconduction electromagnet or a permanent magnet, a usual state conduction electromagnet, etc.
[0045] The inclination coil section 213 is formed in each field where the main magnetic field magnets 212a and 212b have countered. Specifically, the pole piece 218a and 218b of the pair which makes homogeneity the static magnetic field of the boa 211 with which the analyte 50 contained in the inclination coil section 213 is inserted is formed in each field where the main magnetic field magnets 212a and 212b have countered. The inclination coils 213a and 213b of a pair which generate a gradient magnetic field, and the passive boats 219a and 219b for adjusting the homogeneity of a static magnetic field carry out a laminating to the building envelope of the pole piece 218a and 218b of a pair, and are formed in it.
[0046] The inclination coil section 213 which has such a configuration generates the gradient magnetic field which attaches inclination to the reinforcement of the static magnetic field which the main magnetic field magnet section 212 formed, in order to give the positional information of a three dimension to the magnetic resonance signal which the RF-coil section 214 receives. The gradient magnetic field which the inclination coil section 213 generates is three kinds, a slice (slice) gradient magnetic field, a lead-out (read out) gradient magnetic field, and a phase encoding (phase encode) gradient magnetic field, and the inclination coil section 213 has three inclination coils corresponding to these three kinds of gradient magnetic fields.
[0047] The hold sections 220a and 220b of a pair are formed in each field where the inclination coil section 213 of a pair counters, and RF coils 214a and 214b are formed in the space of the hold sections 220a and 220b of these pairs.
[0048] The RF-coil section 214 which has the hold sections 220a and 220b and RF coils 214a and 214b of this pair forms the RF magnetic field for exciting the spin of the inside of the body of analyte 50 in the static magnetic field space which the main magnetic field magnet section 212 formed. Here, it is called transmission of RF excitation signal to form a RF magnetic field. The RF-coil section 214 receives the electromagnetic wave which the excited spin produces as a magnetic resonance signal. The RF-coil section 214 has the coil for transmission and the coil for reception which are not illustrated. The coil for transmission and the coil for reception make the same coil serve a double purpose, or the coil of dedication is used for them, respectively.
[0049] And in the operation gestalt of **** 1, as shown in drawing 3 , the end section of the path 41 of the cooling style to which it shows the cooling wind ventilated from the cooling system 40 arranged at the machine room 13 is connected to the hold sections 220a and 220b of the RF-coil section 214 so that a cooling wind may be introduced in the hold space of RF coils 214a and 214b of the hold sections 220a and 220b.
[0050] The RF mechanical component 22 gives the driving signal DR1 corresponding to a protocol

based on directions of a control section 25 to the RF-coil section 214, generates RF excitation signal, and excites the spin of the inside of the body of analyte 50.
[0051] The inclination mechanical component 23 gives the driving signal DR2 corresponding to a protocol based on directions of a control section 25 to the inclination coil section 213, and generates a gradient magnetic field. The inclination mechanical component 23 has three drive circuits which are not illustrated corresponding to three inclination coils of the inclination coil section 213.
[0052] The data collection section 24 incorporates the input signal which the RF-coil section 214 received, collects them as viewdata (view data), and outputs them to the data-processing section 31 of an operator console 30.
[0053] A control section 25 is based on the protocol corresponding to the tested part of the analyte 50 sent from the data-processing section 31 of an operator console 30 which should be performed, and controls the RF mechanical component 22 to impress the driving signal DR1 with which a predetermined pulse sequence is repeated the number of predetermined times within the repetition time TR decided beforehand to the RF-coil section 214. Similarly, a control section 25 is based on the protocol which should be performed, and controls the inclination mechanical component 23 to impress the pulse signal of a predetermined pattern to the inclination coil 213 in 1TR. Moreover, a control section 25 incorporates the input signal which the RF-coil section 214 received, collects them as viewdata (view data), and controls the data collection section 24 to output to the data-processing section 31 of an operator console 30.
[0054] In addition, in order that the protocol which is specified as a control section 25 and which should be performed may perform magnetic resonance photography, it is set corresponding to the tested part of analyte 50, and the counts of a repeat of the pulse sequence in 1TR (repetition time) differ for every protocol.
[0055] this pulse sequence for magnetic resonance photography -- the so-called spin echo (SE:Spin Echo) -- law and a gradient echo (GRE:GRadient Echo) -- law and a first spin echo (FSE:Fast Spin Echo) -- law and the first recovery FSE (Fast Recovery Spin Echo) -- law and echo PURANA imaging (EPI:Echo PlanarImaging) -- it changes with each photography methods, such as law.
[0056] Here, among the pulse sequences of each photography method, it relates and the pulse sequence of the SE method is explained to drawing 4 . Drawing 4 (a) is the sequence of the 90 degree pulse for RF excitation in the SE method, and 180-degree pulse, and is equivalent to the driving signal DR1 which the RF mechanical component 22 impresses to the RF-coil section 214. Drawing 4 (b), (c), (d), and (e) are the sequences of the slice inclination Gs, the lead-out inclination Gr, the phase encoding inclination Gp, and a spin echo MR, respectively, and the pulse of the slice inclination Gs, the lead-out inclination Gr, and the phase encoding inclination Gp is equivalent to the driving signal DR2 which the inclination mechanical component 23 impresses to the inclination coil section 213.
[0057] As shown in drawing 4 (a), a 90 degree pulse is impressed by the RF mechanical component 22 to the RF-coil section 214, and 90-degree excitation of spin is performed. At this time, as shown in drawing 4 (b), the slice gradient pulse Gs is impressed by the inclination mechanical component 23 to the inclination coil section 213, and selective excitation is performed about a predetermined slice. As shown in drawing 4 (a), 180-degree pulse is impressed by the RF mechanical component 22 from 90-degree excitation to the RF-coil section 214 after predetermined time amount, and 180-degree excitation, i.e., spin reversal, is performed. As shown in drawing 4 (b) also at this time, the slice gradient pulse Gs is impressed by the inclination mechanical component 23 to the inclination coil section 213, and alternative reversal is performed about the same slice.
[0058] As shown in drawing 4 (c) and (d), the lead-out gradient pulse Gr and the phase encoding gradient pulse Gp are impressed to the period between 90-degree excitation and spin reversal by the inclination mechanical component 23 to the inclination coil section 213. And DIFEZU of spin is performed by the lead-out gradient pulse Gr, and phase encoding of spin is performed by the phase encoding gradient pulse Gp.
[0059] As shown in drawing 4 (b) after spin reversal, the lead-out gradient pulse Gr is impressed by the inclination mechanical component 23 to the inclination coil section 213, are RIFEZU, and as shown in

drawing 4 (e), a spin echo MR is generated. These spin echoes MR are collected by the data collection section 24 as viewdata.
[0060] A control section 25 is such a pulse sequence, and controls the RF mechanical component 22, the inclination mechanical component 23, and the data collection section 24 according to an activation protocol to repeat 64 to 512 times a period TR, for example. Moreover, a control section 25 controls to change the phase encoding gradient pulse Gp at every repeat, and to perform phase encoding different each time.
[0061] Since the counts of a repeat differ in a pulse sequence for every activation protocol as mentioned above, the calorific value in the time 214 of protocol activation, i.e., the RF-coil section by impression of a driving signal DR1, differs for every protocol. Then, without performing too much cooling with a cooling system 40 for every protocol with reference to the look-up table LTB as shown in drawing 5 memorized by the memory 251 as a storage means, if there is assignment of the protocol which should be performed by the data-processing section 31 of an operator console 30, a control section 25 generates the control signal CTL1 it is directed that cools the RF-coil section 214 with the optimal refrigeration capacity, and outputs it to a cooling system 40. A control section 25 generates a control signal CTL1 so that the drive power of the motor for cooling of a cooling system 40 may follow the protocol which should be performed.
[0062] the refrigeration capacity corresponding to the prediction calorific value in the above-mentioned [whole protocol] RF coil according to activation of each protocol with which the counts of a repeat of a pulse sequence repeat within a time differ in a look-up table LTB -- beforehand -- a setup -- now, it is.
[0063] In the look-up table LTB shown in drawing 5 , an example of the refrigeration capacity which should be directed to the tested part corresponding to a protocol and a cooling system 40 is shown. The refrigeration capacity shown in a look-up table LTB expresses numerically the refrigeration capacity corresponding to the program which should each perform at the time of setting the maximum refrigeration capacity of a cooling system 40 to 1. In the example of drawing 5 , a tested part is a head and the protocol number 1 shows that refrigeration capacity should just drive with 0.7 (70 percent) degree to the maximum capacity. Similarly, a tested part is a cervix and the protocol number 2 shows that refrigeration capacity should just drive with 0.6 (60 percent) degree to the maximum capacity. A tested part is a thorax and the protocol number 3 shows that refrigeration capacity should just drive with 0.8 (80 percent) degree to the maximum capacity. As for the protocol number m, a tested part is a thorax and refrigeration capacity shows that what is necessary is just to drive with 0.85 (80-percent 5 minutes) degree to the maximum capacity.
[0064] A control section 25 generates and outputs a protocol with few counts of a repeat of a pulse sequence for a control signal CTL1 so that refrigeration capacity may be made low.
[0065] The operator console 30 has the data-processing section 31, the control unit 32, and the display 33, as shown in drawing 2 .
[0066] The data-processing section 31 memorizes in memory the data incorporated from the data collection section 24. Data space is formed in memory. The data space formed in memory constitutes the two-dimensional-Fourier space. The data-processing-section 31 carries out the two-dimensional inverse Fourier transform of the data of these two-dimensional Fourier space, and generates the image of analyte 50 (reconstruction). In addition, the two-dimensional Fourier space is also called k space.
[0067] The control section 25 is connected to the data-processing section 31, it is in the high order of a control section 25, and it is generalized. The control unit 32 and the display 33 are connected to data processing 31.
[0068] A control unit 32 is constituted by a keyboard, a mouse, etc. equipped with the pointing device, and outputs the actuation signal according to actuation of Operator OP to the data-processing section 195. Again. From a control unit 32, the input of the protocol which was mentioned above, for example and which should be performed is performed. The data-processing section 31 supplies the information (protocol number etc.) about the protocol inputted from the control unit 32 to a control section 25.
[0069] A display 33 is constituted by graphic display etc. and displays the predetermined information according to the operating state of MRI equipment 20 according to the actuation signal from a control

unit 32.

[0070] A cooling system 40 absorbs the cooling wind by which was constituted by the air-cooling device containing a fan motor, and had the refrigeration capacity according to directions of the control signal CTL1 by the control section 25, for example, the temperature control was carried out, and derives it from the other end to the path 41 of the cooling style. A cooling system 40 is controlled according to the protocol which the drive power of a fan motor should perform with a control signal CTL1. In addition, it is possible for it not to be limited in the case of air cooling of a suction type, and to use various equipments, such as a thing of the thing of the blowdown, water cooling, or oil quenching, as a cooling system.

[0071] As mentioned above, the end section of the path 41 of the cooling style is connected so that a cooling wind may be introduced in the hold space of RF coils 214a and 214b to the hold sections 220a and 220b of the RF-coil section 214.

[0072] Next, actuation by the above-mentioned configuration is related with the flow chart of drawing 6 , and is explained.

[0073] First, the analyte 50 carried on the cradle 26 through the cushion is carried in in the boa 211 of the magnet system 21 of MRI equipment 20 by the conveyance section which is not illustrated (ST1).

[0074] Next, the tested part of analyte 50 is located in the magnet center in a boa 211 (ST2). At this time, the static magnetic field by the main magnetic field magnet section 212 is formed in the predetermined field in the boa 211 including a magnet center.

[0075] And the protocol information corresponding to a tested part is inputted by Operator OP from a control unit 32 (ST3). The information (protocol number etc.) about the protocol inputted from the control unit 32 is supplied to a control section 25 by the data-processing section 31.

[0076] If there is assignment of the protocol which should be performed by the data-processing section 31 of an operator console 30 in a control section 25 The look-up table LTB memorized by the memory 251 as a storage means is referred to (ST4). Without performing too much cooling with a cooling system 40, the control signal CTL1 it is directed that cools the RF-coil section 214 with the optimal refrigeration capacity suitable for the inputted protocol is generated, and it is outputted to a cooling system 40 (ST5).

[0077] In a cooling system 40, the suction of the cooling style by which had the refrigeration capacity according to directions of the control signal CTL1 by the control section 25, for example, the temperature control was carried out is performed, and it is drawn from the other end by the path 41 of the cooling style (ST6). And the cooling wind guided in the path 41 of the cooling style is introduced in the hold space of RF coils 214a and 214b to the hold sections 220a and 220b of the RF-coil section 214. RF coils 214a and 214b are cooled with the refrigeration capacity which was suitable for the protocol performed by this (ST7).

[0078] Moreover, in a control section 25, it is based on the protocol corresponding to the tested part of the analyte 50 sent from the data-processing section 31 of an operator console 30 which should be performed. The RF mechanical component 22 is controlled and it is based on the protocol which should be performed so that the driving signal DR1 with which a predetermined pulse sequence is repeated the number of predetermined times within the repetition time TR decided beforehand may be impressed to the RF-coil section 214. The inclination mechanical component 23 is controlled to impress the pulse signal of a predetermined pattern to the inclination coil 213 in 1TR.

[0079] At the RF mechanical component 22, the driving signal DR1 corresponding to a protocol based on directions of a control section 25 is impressed to the RF-coil section 214, and the driving signal DR2 corresponding to a protocol based on directions of a control section 25 is impressed to the inclination coil section 213 by the inclination mechanical component 23. A gradient magnetic field and a RF magnetic field are formed in the predetermined field in the boa 211 including a magnet center by this, the electromagnetic wave which the spin excited in the tested part of analyte 50 produces is taken out as a magnetic resonance signal, and these is collected in the data collection section 24, and is outputted to the data-processing section 31 of an operator console 30 as data of an inspection result. That is, the image pick-up of a tested part is performed (ST8).

[0080] In the data-processing section 31, the data inputted from the data collection section 24 is memorized by memory, and data space is formed in memory. In the data-processing section 31, the two-dimensional inverse Fourier transform of the data of these two-dimensional Fourier space is carried out, and the image of the tested part of analyte 50 is generated (ST9). (reconstruction)
[0081] And if the data collection of the tested part of analyte 50 is completed, analyte 50 will be taken out besides a boa 211 with a cradle 26 by the conveyance section which is not illustrated (ST10).
[0082] If there is assignment of the protocol which should be performed by the data-processing section 31 of an operator console 30 according to the operation gestalt of **** 1 as explained above The look-up table LTB memorized by memory 251 is referred to. The control section 25 which generates the control signal CTL1 it is directed that cools the RF-coil section 214 with the optimal refrigeration capacity, without performing too much cooling with a cooling system 40 for every protocol, Since the cooling system 40 derived to the path 41 of the cooling style which absorbed the cooling wind by which had the refrigeration capacity according to directions of the control signal CTL1 by the control section 25, for example, the temperature control was carried out, and was connected to the RF-coil section 214 was formed There is an advantage which not only the thing from which the count of a repeat of the pulse sequence in 1TR differs, and for which the drive power for cooling can be set up for every protocol, and generating of image dotage etc. can be prevented but also reduction of power consumption and the noise can plan.
[0083] 2nd operation gestalt drawing 7 is the block diagram showing the 2nd operation gestalt of the MRI system concerning this invention, and drawing 8 is drawing showing the example of an arrangement configuration of the main magnetic field magnet section in the magnet system concerning the operation gestalt of **** 2, the inclination coil section, the RF-coil section, and the path of the cooling style.
[0084] A different point from the 1st operation gestalt which the operation gestalt of **** 2 mentioned above is to have constituted so that the inclination coil section 213 might be cooled with the optimal refrigeration capacity, without performing too much cooling by cooling-system 40A for every protocol instead of the RF-coil section 214.
[0085] Drawing 9 is drawing showing the look-up table of the refrigeration capacity of the inclination coil which control-section 25A concerning the operation gestalt of **** 2 refers to. In the example of drawing 9 , a tested part is a head and the protocol number 1 shows that refrigeration capacity should just drive with 0.7 (70 percent) degree to the greatest ability. Similarly, a tested part is a cervix and the protocol number 2 shows that refrigeration capacity should just drive with 0.6 (60 percent) degree to the maximum capacity. A tested part is a thorax and the protocol number 3 shows that refrigeration capacity should just drive with 0.85 (80-percent 5 minutes) degree to the maximum capacity. As for the protocol number m, a tested part is a thorax and refrigeration capacity shows that what is necessary is just to drive with 0.9 (90 percent) degree to the maximum capacity.
[0086] Control-section 25A which takes six for the 2nd operation gestalt generates and outputs a protocol with few counts of a repeat of a pulse sequence for a control signal CTL2 so that refrigeration capacity may be made low.
[0087] Cooling-system 40A concerning the operation gestalt of **** 2 absorbs the cooling wind by which had the refrigeration capacity according to directions of the control signal CTL2 by control-section 25A, for example, the temperature control was carried out, and derives it to the path 42 of the cooling style connected to the inclination coil section 213.
[0088] And in the operation gestalt of **** 2, as shown in drawing 8 , the end section of the path 42 of the cooling style to which it shows the cooling wind ventilated from cooling-system 40A is connected to the inclination coil section 213 so that a cooling wind may be introduced in the hold space of the inclination coils 213a and 213b.
[0089] Next, actuation concerning the operation gestalt of **** 2 is related with the flow chart of drawing 10 , and is explained.
[0090] First, the analyte 50 carried on the cradle 26 through the cushion is carried in in the boa 211 of the magnet system 21 of MRI equipment 20 by the conveyance section which is not illustrated (ST11).

[0091] Next, the tested part of analyte 50 is located in the magnet center in a boa 211 (ST12). At this time, the static magnetic field by the main magnetic field magnet section 212 is formed in the predetermined field in the boa 211 including a magnet center.
[0092] And the protocol information corresponding to a tested part is inputted by Operator OP from a control unit 32 (ST13). The information (protocol number etc.) about the protocol inputted from the control unit 32 is supplied to control-section 25A by the data-processing section 31.
[0093] If there is assignment of the protocol which should be performed by the data-processing section 31 of an operator console 30 in control-section 25A The look-up table LTBa memorized by memory 251a as a storage means is referred to (ST14). Without performing too much cooling by cooling-system 40A, the control signal CTL2 it is directed that cools the inclination coil section 213 with the optimal refrigeration capacity suitable for the inputted protocol is generated, and it is outputted to cooling-system 40A (ST15).
[0094] In cooling-system 40A, the suction of the cooling style by which had the refrigeration capacity according to directions of the control signal CTL2 by control-section 25A, for example, the temperature control was carried out is performed, and it is drawn from the other end by the path 42 of the cooling style (ST16). And the cooling wind guided in the path 42 of the cooling style is introduced in the hold space of the inclination coils 213a and 213b of the inclination coil section 213. The inclination coils 213a and 213b are cooled with the refrigeration capacity which was suitable for the protocol performed by this (ST17).
[0095] Moreover, in control-section 25A, it is based on the protocol corresponding to the tested part of the analyte 50 sent from the data-processing section 31 of an operator console 30 which should be performed. The RF mechanical component 22 is controlled and it is based on the protocol which should be performed so that the driving signal DR1 with which a predetermined pulse sequence is repeated the number of predetermined times within the repetition time TR decided beforehand may be impressed to the RF-coil section 214. The inclination mechanical component 23 is controlled to impress the pulse signal of a predetermined pattern to the inclination coil 213 in 1TR.
[0096] At the RF mechanical component 22, the driving signal DR1 corresponding to a protocol based on directions of control-section 25A is impressed to the RF-coil section 214, and the driving signal DR2 corresponding to a protocol based on directions of a control section 25 is impressed to the inclination coil section 213 by the inclination mechanical component 23. A gradient magnetic field and a RF magnetic field are formed in the predetermined field in the boa 211 including a magnet center by this, the electromagnetic wave which the spin excited in the tested part of analyte 50 produces is taken out as a magnetic resonance signal, and these is collected in the data collection section 24, and is outputted to the data-processing section 31 of an operator console 30 as data of an inspection result. That is, the image pick-up of a tested part is performed (ST18).
[0097] In the data-processing section 31, the data inputted from the data collection section 24 is memorized by memory, and data space is formed in memory. In the data-processing section 31, the two-dimensional inverse Fourier transform of the data of these two-dimensional Fourier space is carried out, and the image of the tested part of analyte 50 is generated (ST19). (reconstruction)
[0098] And if the data collection of the tested part of analyte 50 is completed, analyte 50 will be taken out besides a boa 211 with a cradle 26 by the conveyance section which is not illustrated (ST20).
[0099] If there is assignment of the protocol which should be performed by the data-processing section 31 of an operator console 30 according to the operation gestalt of **** 2 as explained above The look-up table LTBa memorized by memory 251 is referred to. Control-section 25A which generates the control signal CTL2 it is directed that cools the inclination coil section 213 with the optimal refrigeration capacity, without performing too much cooling by cooling-system 40A for every protocol, Since cooling-system 40A derived to the path 42 of the cooling style which absorbed the cooling wind by which had the refrigeration capacity according to directions of the control signal CTL2 by control-section 25A, for example, the temperature control was carried out, and was connected to the inclination coil section 213 was prepared There is an advantage which can prevent the drift of the resonance frequency by pyrexia of an inclination coil, and can prevent a ghost's generating in a reconstruction

image.
[0100] 3rd operation gestalt drawing 11 is the block diagram showing the 3rd operation gestalt of the MRI system concerning this invention, and drawing 12 is drawing showing the example of an arrangement configuration of the main magnetic field magnet section in the magnet system concerning the operation gestalt of **** 2, the inclination coil section, the RF-coil section, and the path of the cooling style.
[0101] without performing too much cooling with cooling systems 40 and 40A for every protocol instead of seeing and cooling the gestalt 214 which coalesced the 1st operation gestalt and the 2nd operation gestalt which were mentioned above, i.e., the RF-coil section, in the inclination coil section 213, the operation gestalt of **** 3 is constituted so that cooling of the RF-coil section 214 and the inclination coil section 213 may be performed with the optimal refrigeration capacity.
[0102] Drawing 13 is drawing showing the look-up table of the refrigeration capacity of the RF coil which control-section 25B concerning the operation gestalt of **** 3 refers to, and an inclination coil. The look-up table TBLb of drawing 13 takes a configuration which coalesced drawing 5 and drawing 9 , refrigeration capacity 1 shows the refrigeration capacity of RF-coil correspondence among drawing, and refrigeration capacity 2 shows the refrigeration capacity corresponding to an inclination coil. In the example of drawing 13 , a tested part is a head and the protocol number 1 shows that refrigeration capacity 1 and 2 should just drive with 0.7 (70 percent) degree to the greatest ability. Similarly, a tested part is a cervix and the protocol number 2 shows that refrigeration capacity 1 and 2 should just drive with 0.6 (60 percent) degree to the maximum capacity. The protocol number 3 shows that refrigeration capacity 2 should just drive with 0.85 (80-percent 5 minutes) degree to the maximum capacity that what is necessary is for a tested part to be a thorax and just to drive refrigeration capacity 1 with 0.8 (80 percent) degree to the maximum capacity. As for the protocol number m, refrigeration capacity 2 shows that what is necessary is just to drive with 0.9 (90 percent) degree to the maximum capacity that what is necessary is for a tested part to be a thorax and just to drive refrigeration capacity 1 with 0.85 (80-percent 5 minutes) degree to the maximum capacity.
[0103] Control-section 25B concerning the operation gestalt of **** 3 generates and outputs a protocol with few counts of a repeat of a pulse sequence for control signals CTL1 and CTL2 so that refrigeration capacity may be made low.
[0104] The cooling system 40 concerning the operation gestalt of **** 3 absorbs the cooling wind by which had the refrigeration capacity according to directions of the control signal CTL1 by control-section 25B, for example, the temperature control was carried out, and derives it to the path 41 of the cooling style connected to the RF-coil section 214. Moreover, pulse C cooling-system 40A absorbs the cooling wind by which had the refrigeration capacity according to directions of the control signal CTL2 by control-section 25B, for example, the temperature control was carried out, and derives it to the path 42 of the cooling style connected to the inclination coil section 213.
[0105] And in the operation gestalt of **** 3, as shown in drawing 12 , the end section of the path 41 of the cooling style to which it shows the cooling wind ventilated from the cooling system 40 is connected to the RF-coil section 214 so that a cooling wind may be introduced in the hold space of RF coils 214a and 214b. Moreover, the end section of the path 42 of the cooling style to which it shows the cooling wind ventilated from cooling-system 40A is connected to the inclination coil section 213 so that a cooling wind may be introduced in the hold space of the inclination coils 213a and 213b.
[0106] Next, actuation concerning the operation gestalt of **** 3 is related with the flow chart of drawing 14 , and is explained.
[0107] First, the analyte 50 carried on the cradle 26 through the cushion is carried in in the boa 211 of the magnet system 21 of MRI equipment 20 by the conveyance section which is not illustrated (ST21).
[0108] Next, the tested part of analyte 50 is located in the magnet center in a boa 211 (ST22). At this time, the static magnetic field by the main magnetic field magnet section 212 is formed in the predetermined field in the boa 211 including a magnet center.
[0109] And the protocol information corresponding to a tested part is inputted by Operator OP from a control unit 32 (ST23). The information (protocol number etc.) about the protocol inputted from the

control unit 32 is supplied to control-section 25B by the data-processing section 31.
[0110] Without referring to the look-up table LTBb memorized by memory 251b as a storage means (ST24), and performing too much cooling with a cooling system 40, if there is assignment of the protocol which should be performed by the data-processing section 31 of an operator console 30 in control-section 25B, the control signal CTL1 it is directed that cools the RF-coil section 214 with the optimal refrigeration capacity suitable for the inputted protocol is generated, and it is outputted to a cooling system 40. Similarly, in control-section 40A, without performing too much cooling by cooling-system 40A, the control signal CTL2 it is directed that cools the inclination coil section 213 with the optimal refrigeration capacity suitable for the inputted protocol is generated, and it is outputted to cooling-system 40A (ST25).
[0111] In a cooling system 40, the suction of the cooling style by which had the refrigeration capacity according to directions of the control signal CTL1 by control-section 25B, for example, the temperature control was carried out is performed, and it is drawn from the other end by the path 41 of the cooling style (ST26). And the cooling wind guided in the path 41 of the cooling style is introduced in the hold space of RF coils 214a and 214b of the RF-coil section 214. RF coils 214a and 214b are cooled with the refrigeration capacity which was suitable for the protocol performed by this (ST27). Similarly, in cooling-system 40A, the suction of the cooling style by which had the refrigeration capacity according to directions of the control signal CTL2 by control-section 25B, for example, the temperature control was carried out is performed, and it is drawn from the other end by the path 42 of the cooling style (ST26). And the cooling wind guided in the path 42 of the cooling style is introduced in the hold space of the inclination coils 213a and 213b of the inclination coil section 213. The inclination coils 213a and 213b are cooled with the refrigeration capacity which was suitable for the protocol performed by this (ST27).
[0112] Moreover, in control-section 25B, it is based on the protocol corresponding to the tested part of the analyte 50 sent from the data-processing section 31 of an operator console 30 which should be performed. The RF mechanical component 22 is controlled and it is based on the protocol which should be performed so that the driving signal DR1 with which a predetermined pulse sequence is repeated the number of predetermined times within the repetition time TR decided beforehand may be impressed to the RF-coil section 214. The inclination mechanical component 23 is controlled to impress the pulse signal of a predetermined pattern to the inclination coil 213 in 1TR.
[0113] At the RF mechanical component 22, the driving signal DR1 corresponding to a protocol based on directions of control-section 25B is impressed to the RF-coil section 214, and the driving signal DR2 corresponding to a protocol based on directions of a control section 25 is impressed to the inclination coil section 213 by the inclination mechanical component 23. A gradient magnetic field and a RF magnetic field are formed in the predetermined field in the boa 211 including a magnet center by this, the electromagnetic wave which the spin excited in the tested part of analyte 50 produces is taken out as a magnetic resonance signal, and these is collected in the data collection section 24, and is outputted to the data-processing section 31 of an operator console 30 as data of an inspection result. That is, the image pick-up of a tested part is performed (ST28).
[0114] In the data-processing section 31, the data inputted from the data collection section 24 is memorized by memory, and data space is formed in memory. In the data-processing section 31, the two-dimensional inverse Fourier transform of the data of these two-dimensional Fourier space is carried out, and the image of the tested part of analyte 50 is generated (ST29). (reconstruction)
[0115] And if the data collection of the tested part of analyte 50 is completed, analyte 50 will be taken out besides a boa 211 with a cradle 26 by the conveyance section which is not illustrated (ST30).
[0116] As explained above, according to the operation gestalt of **** 3, the effect same in the 1st operation gestalt mentioned above as an effect and the effect of the 2nd operation gestalt can be acquired. That is, not only the thing from which the count of a repeat of the pulse sequence in 1TR differs and for which the drive power for cooling can be set up for every protocol, and generating of image dotage etc. can be prevented but also reduction of power consumption and the noise can be planned. Moreover, there is an advantage which can prevent the drift of the resonance frequency by

pyrexia of an inclination coil, and can prevent a ghost's generating in a reconstruction image.
[0117] 4th operation gestalt drawing 15 is the block diagram showing the 4th operation gestalt of the MRI system concerning this invention.
[0118] The point that the operation gestalt of **** 4 differs from the 3rd operation gestalt mentioned above is to have constituted so that cooling of the RF-coil section 214 and the inclination coil section 213 might be performed with the optimal refrigeration capacity, without performing too much cooling with one cooling system 40 for every protocol instead of the cooling system of heat performing cooling of the gestalt 214 which coalesced **, i.e., the RF-coil section, and the inclination coil section 213.
[0119] What has the look-up table [be / the same as that of what is shown in drawing 13 / it] of the refrigeration capacity of the RF coil which control-section 25C concerning the operation gestalt of **** 4 refers to, and an inclination coil is used. That is, by the look-up table TBLb of drawing 13 , refrigeration capacity 1 shows the refrigeration capacity of RF-coil correspondence, and refrigeration capacity 2 shows the refrigeration capacity corresponding to an inclination coil by it. In this example, a tested part is a head and the protocol number 1 shows that refrigeration capacity 1 and 2 should just drive with 0.7 (70 percent) degree to the greatest ability. Similarly, a tested part is a cervix and the protocol number 2 shows that refrigeration capacity 1 and 2 should just drive with 0.6 (60 percent) degree to the maximum capacity. The protocol number 3 shows that refrigeration capacity 2 should just drive with 0.85 (80-percent 5 minutes) degree to the maximum capacity that what is necessary is for a tested part to be a thorax and just to drive refrigeration capacity 1 with 0.8 (80 percent) degree to the maximum capacity. As for the protocol number m, refrigeration capacity 2 shows that what is necessary is just to drive with 0.9 (90 percent) degree to the maximum capacity that what is necessary is for a tested part to be a thorax and just to drive refrigeration capacity 1 with 0.85 (80-percent 5 minutes) degree to the maximum capacity.
[0120] Control-section 25C concerning the operation gestalt of **** 4 generates and outputs a protocol with few counts of a repeat of a pulse sequence for a control signal CTL1 so that refrigeration capacity may be made low. However, like the example shown in drawing 13 mentioned above, control-section 25C generates the control signal CTL1 based on the refrigeration capacity of the side which needs large refrigeration capacity, when the refrigeration capacity 1 and the refrigeration capacity 2 corresponding to an inclination coil corresponding to an RF coil differ from each other. In this example, since the refrigeration capacity 2 corresponding to an inclination coil may be larger than the refrigeration capacity 1 of RF-coil correspondence, the control signal CTL1 based on the refrigeration capacity 2 of a look-up table TLBb is generated. In this case, although an RF coil will be cooled with larger refrigeration capacity than the optimal refrigeration capacity, when performing the same protocol, in actual cooling, it does not become too much cooling from what do not differ extremely, and calorific value in the RF-coil section 214 and the inclination coil section 213 can be cooled with suitable capacity.
[0121] The cooling system 40 concerning the operation gestalt of **** 4 absorbs the cooling wind by which had the refrigeration capacity according to directions of the control signal CTL1 by control-section 25B, for example, the temperature control was carried out, and derives it to path of cooling style 41A connected so that it might branch in the RF-coil section 214 and the inclination coil section 213.
[0122] Next, actuation concerning the operation gestalt of **** 3 is related with the flow chart of drawing 16 , and is explained.
[0123] First, the analyte 50 carried on the cradle 26 through the cushion is carried in in the boa 211 of the magnet system 21 of MRI equipment 20 by the conveyance section which is not illustrated (ST31).
[0124] Next, the tested part of analyte 50 is located in the magnet center in a boa 211 (ST32). At this time, the static magnetic field by the main magnetic field magnet section 212 is formed in the predetermined field in the boa 211 including a magnet center.
[0125] And the protocol information corresponding to a tested part is inputted by Operator OP from a control unit 32 (ST33). The information (protocol number etc.) about the protocol inputted from the control unit 32 is supplied to control-section 25C by the data-processing section 31.
[0126] In control-section 25C, if there is assignment of the protocol which should be performed by the data-processing section 31 of an operator console 30, the look-up table LTBb memorized by memory

251b as a storage means will be referred to (ST34). And distinction with equal refrigeration capacity 1 and refrigeration capacity 2 corresponding to an inclination coil corresponding to an RF coil is performed, and it is **** (ST35). In step S35, when the refrigeration capacity 1 and the refrigeration capacity 2 corresponding to an inclination coil corresponding to an RF coil were equal and it is distinguished, the control signal CTL1 which the refrigeration capacity embraced is generated, and it is outputted to a cooling system 40 (ST36). On the other hand, when the refrigeration capacity 1 and the refrigeration capacity 2 corresponding to an inclination coil corresponding to an RF coil were not equal and it is distinguished in step S35, the control signal CTL1 according to the refrigeration capacity of the larger one is generated, and it is outputted to a cooling system 40 (ST37). Thereby, without performing too much cooling with a cooling system 40, the control signal CTL1 it is directed that performs cooling of the RF-coil section 214 and the inclination coil section 213 with the optimal refrigeration capacity suitable for the inputted protocol is generated, and it is outputted to a cooling system 40.

[0127] In a cooling system 40, the suction of the cooling style by which had the refrigeration capacity according to directions of the control signal CTL1 by control-section 25C, for example, the temperature control was carried out is performed, and it is drawn from the other end by the path 41 of the cooling style (ST38). And the cooling wind guided in the path 41 of the cooling style is introduced in the hold space of RF coils 214a and 214b of the RF-coil section 214, and the hold space of the inclination coils 213a and 213b of the inclination coil section 213. RF coils 214a and 214b and the inclination coils 213a and 213b of the inclination coil section 213 are cooled with the refrigeration capacity which was suitable for the protocol performed by this (ST39).

[0128] Moreover, in control-section 25C, it is based on the protocol corresponding to the tested part of the analyte 50 sent from the data-processing section 31 of an operator console 30 which should be performed. The RF mechanical component 22 is controlled and it is based on the protocol which should be performed so that the driving signal DR1 with which a predetermined pulse sequence is repeated the number of predetermined times within the repetition time TR decided beforehand may be impressed to the RF-coil section 214. The inclination mechanical component 23 is controlled to impress the pulse signal of a predetermined pattern to the inclination coil 213 in 1TR.

[0129] At the RF mechanical component 22, the driving signal DR1 corresponding to a protocol based on directions of control-section 25C is impressed to the RF-coil section 214, and the driving signal DR2 corresponding to a protocol based on directions of a control section 25 is impressed to the inclination coil section 213 by the inclination mechanical component 23. A gradient magnetic field and a RF magnetic field are formed in the predetermined field in the boa 211 including a magnet center by this, the electromagnetic wave which the spin excited in the tested part of analyte 50 produces is taken out as a magnetic resonance signal, and these is collected in the data collection section 24, and is outputted to the data-processing section 31 of an operator console 30 as data of an inspection result. That is, the image pick-up of a tested part is performed (ST40).

[0130] In the data-processing section 31, the data inputted from the data collection section 24 is memorized by memory, and data space is formed in memory. In the data-processing section 31, the two-dimensional inverse Fourier transform of the data of these two-dimensional Fourier space is carried out, and the image of the tested part of analyte 50 is generated (ST41). (reconstruction)

[0131] And if the data collection of the tested part of analyte 50 is completed, analyte 50 will be taken out besides a boa 211 with a cradle 26 by the conveyance section which is not illustrated (ST42).

[0132] As explained above, according to the operation gestalt of **** 4, the effect of the 3rd operation gestalt mentioned above and the same effect can be acquired. That is, not only the thing from which the count of a repeat of the pulse sequence in 1TR differs and for which the drive power for cooling can be set up for every protocol, and generating of image dotage etc. can be prevented but also reduction of power consumption and the noise can be planned. Moreover, there is an advantage which can prevent the drift of the resonance frequency by pyrexia of an inclination coil, and can prevent a ghost's generating in a reconstruction image. Furthermore, according to the operation gestalt of **** 4, since one line is sufficient as a cooling system or piping, in addition to the effect of the 3rd operation gestalt, increase of system cost and increase of power consumption can be inhibited, and there is an advantage

which can build a practical system.
[0133] In the above explanation, for every [in addition,] protocol with which the counts of a repeat of the pulse sequence within repetition time differ Although the example by which the refrigeration capacity corresponding to the prediction calorific value in the above-mentioned RF coil according to activation of each protocol controls the refrigeration capacity of a cooling system 40 beforehand with reference to a setup, now the look-up table which is was explained This invention is not limited to this and sets assignment of a protocol to a carrier beam control section. For example, calorific value is calculated based on the height (strength) and width of face (time amount) of a sequence pulse which are generated within the repetition time of the driving signal used for the protocol. It is also possible to constitute so that the optimal refrigeration capacity may be drawn from this calculated calorific value and the refrigeration capacity of a cooling system 40 may be controlled based on this.
[0134]
[Effect of the Invention] As explained above, according to this invention, there is an advantage which not only the thing from which the count of a repeat of the pulse sequence in 1 repetition time differs, and for which the drive power for cooling can be set up for every protocol, and generating of image dotage etc. can be prevented but also reduction of power consumption and the noise can plan.
[0135] Moreover, according to this invention, there is an advantage which can prevent the drift of the resonance frequency by pyrexia of an inclination coil, and can prevent a ghost's generating in a reconstruction image.
[0136] Moreover, according to this invention, increase of system cost and increase of power consumption can be inhibited, and there is an advantage which can build a practical system.

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] Magnetic resonance photography equipment which is characterized by providing the following and which holds analyte in static magnetic field space, and photos a tested part of analyte using magnetic resonance An RF coil which forms a magnetic field for excitation for exciting spin in the above-mentioned analyte in response to a driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand An RF-coil driving means which supplies the above-mentioned driving signal according to a protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ to the above-mentioned RF coil A cooling means to cool the above-mentioned RF coil with refrigeration capacity according to a control signal A control means which outputs the above-mentioned control signal according to a protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ to the above-mentioned cooling means
[Claim 2] The above-mentioned control means is magnetic resonance photography equipment according to claim 1 with which a protocol with few counts of a repeat of a pulse sequence generates and outputs the above-mentioned control signal so that refrigeration capacity may be made low.
[Claim 3] For every protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ A storage means by which refrigeration capacity corresponding to prediction calorific value in the above-mentioned RF coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned RF-coil driving means and a control means. The above-mentioned control means Magnetic resonance photography equipment according to claim 1 or 2 which outputs the above-mentioned control signal to the above-mentioned cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.
[Claim 4] Magnetic resonance photography equipment which is characterized by providing the following and which holds analyte in static magnetic field space, forms a magnetic field for excitation in the static magnetic field space concerned, and photos a tested part of analyte using magnetic resonance An inclination coil which forms a gradient magnetic field for attaching inclination to reinforcement of the above-mentioned static magnetic field in response to a driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand An inclination coil driving means which supplies the above-mentioned driving signal according to a protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ to the above-mentioned inclination coil A cooling means to cool the above-mentioned inclination coil with refrigeration capacity according to a control signal A control means which outputs the above-mentioned control signal according to a protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ to the above-mentioned cooling means
[Claim 5] The above-mentioned control means is magnetic resonance photography equipment according to claim 4 with which a protocol with few counts of a repeat of a pulse sequence generates and outputs the above-mentioned control signal so that refrigeration capacity may be made low.
[Claim 6] For every protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ A storage means by which refrigeration capacity corresponding to prediction calorific value in the above-mentioned inclination coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned inclination coil driving means and a control means. The above-mentioned control means Magnetic resonance photography equipment according to claim 4 or 5 which outputs the above-mentioned control signal to the above-mentioned cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.
[Claim 7] Magnetic resonance photography equipment which is characterized by providing the

following and which holds analyte in static magnetic field space, and photos a tested part of analyte using magnetic resonance An RF coil which forms a magnetic field for excitation for exciting spin in the above-mentioned analyte in response to the 1st driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand An inclination coil which forms a gradient magnetic field for attaching inclination to reinforcement of the above-mentioned static magnetic field in response to the 2nd driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand an RF-coil driving means which supplies the 1st driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned RF coil with an inclination coil driving means which supplies the 2nd driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned inclination coil The 1st cooling means which cools the above-mentioned RF coil with refrigeration capacity according to the 1st control signal, The 2nd cooling means which cools the above-mentioned inclination coil with refrigeration capacity according to that of the 2nd control signal, a control means which outputs the 1st control signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to a cooling means of the above 1st, and outputs the 2nd control signal of the above to a cooling means of the above 2nd
[Claim 8] The above-mentioned control means is magnetic resonance photography equipment according to claim 7 with which a protocol with few counts of a repeat of a pulse sequence generates and outputs the 1st and 2nd control signals of the above so that refrigeration capacity may be made low.
[Claim 9] For every protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ A storage means by which refrigeration capacity corresponding to prediction calorific value in the above-mentioned RF coil and an inclination coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned RF-coil driving means, an inclination coil driving means, and a control means. The above-mentioned control means Magnetic resonance photography equipment according to claim 7 or 8 which outputs the 1st and 2nd control signals of the above to the above 1st and the 2nd cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.
[Claim 10] Magnetic resonance photography equipment which is characterized by providing the following and which holds analyte in static magnetic field space, and photos a tested part of analyte using magnetic resonance An RF coil which forms a magnetic field for excitation for exciting spin in the above-mentioned analyte in response to the 1st driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand An inclination coil which forms a gradient magnetic field for attaching inclination to reinforcement of the above-mentioned static magnetic field in response to the 2nd driving signal with which a predetermined pulse sequence is repeated within repetition time decided beforehand an RF-coil driving means which supplies the 1st driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned RF coil an inclination coil driving means which supplies the 2nd driving signal of the above according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned inclination coil, a cooling means cool the above-mentioned RF coil with refrigeration capacity according to a control signal, and a control means which outputs the above-mentioned control signal according to a protocol with which counts of a repeat of a pulse sequence repeat within a time [above-mentioned] differ to the above-mentioned cooling means
[Claim 11] The above-mentioned control means is magnetic resonance photography equipment according to claim 10 with which a protocol with few counts of a repeat of a pulse sequence generates and outputs the above-mentioned control signal so that refrigeration capacity may be made low.
[Claim 12] For every protocol with which counts of a repeat of a pulse sequence within the above-mentioned repetition time differ A storage means by which refrigeration capacity corresponding to

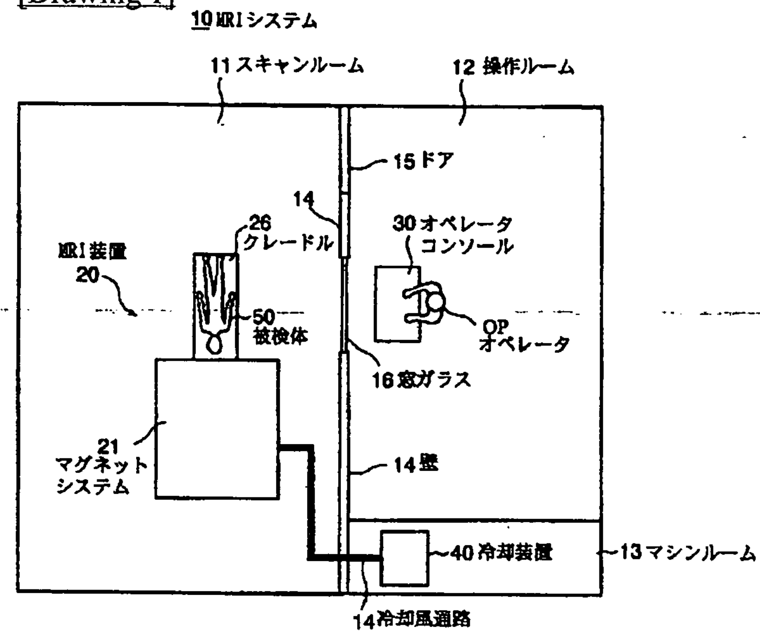
prediction calorific value in the above-mentioned RF coil and an inclination coil according to activation of each protocol memorizes a table set up beforehand, It has further a directions means to direct a protocol which should be performed to the above-mentioned RF-coil driving means, an inclination coil driving means, and a control means. The above-mentioned control means Magnetic resonance photography equipment according to claim 10 or 11 which outputs the above-mentioned control signal to the above-mentioned cooling means so that it may cool with reference to a table of the above-mentioned storage means in response to directions of the above-mentioned directions means with corresponding refrigeration capacity.

[Claim 13] The above-mentioned control means is claims 10 and 11 which output the above-mentioned control signal to the above-mentioned cooling means so that cooling may be performed [refrigeration capacity of the higher one] for ******, when refrigeration capacity which calorific value in the above-mentioned RF coil and an inclination coil should differ and control in the above-mentioned protocol which carries out activation differs, or magnetic resonance photography equipment given in 12.

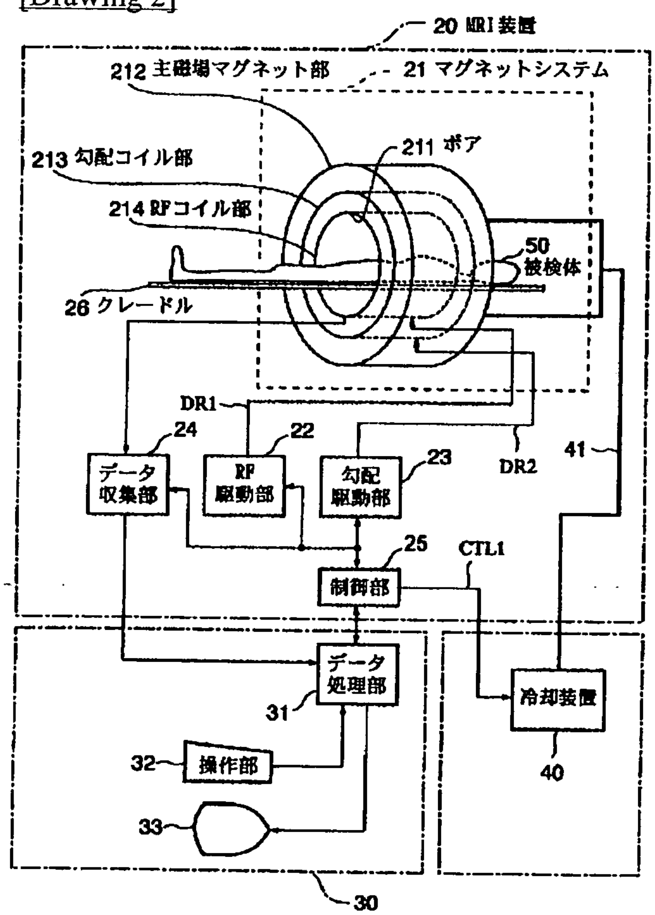
[Translation done.]

DRAWINGS

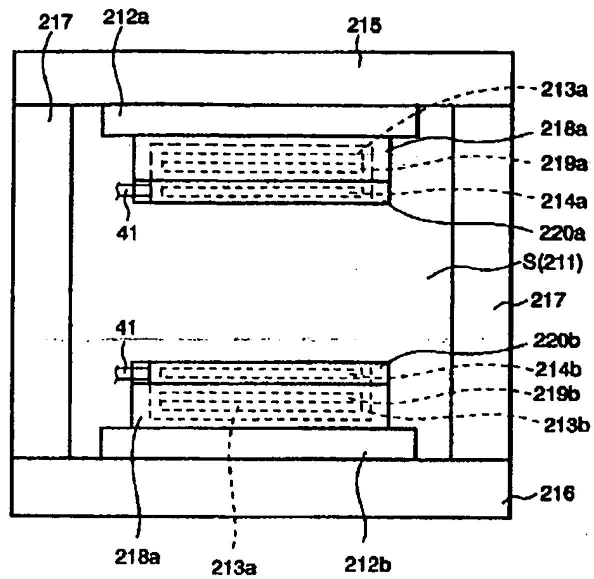
[Drawing 1]



[Drawing 2]



[Drawing 3]



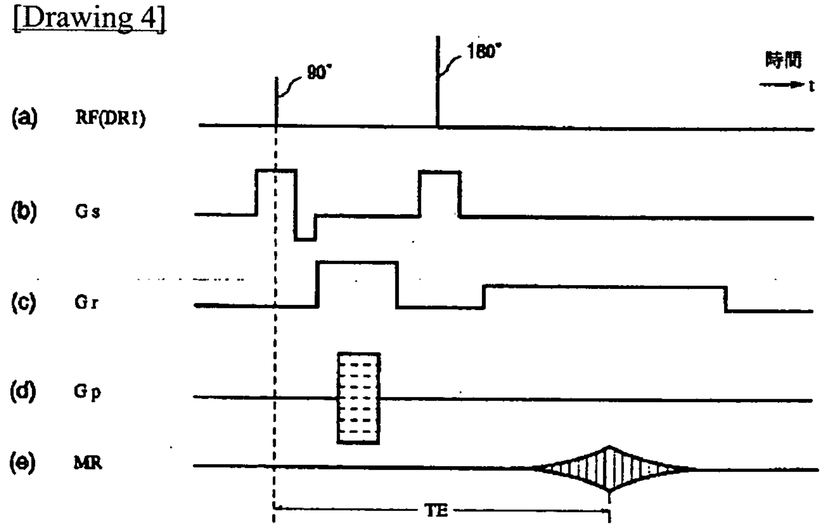
[Drawing 9]

251a

LTBa

プロトコルNo.	被検部位	冷却能力
1	頭部	0.7
2	頸部	0.6
3	胸部	0.85
⋮		
m	腹部	0.9

[Drawing 4]



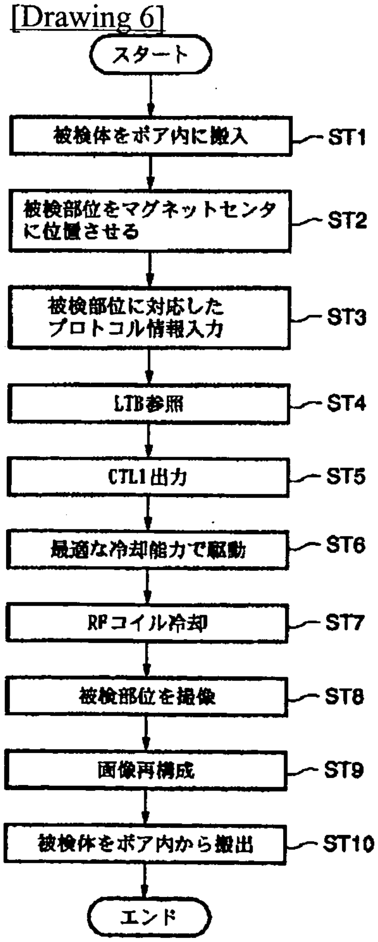
[Drawing 5]

251

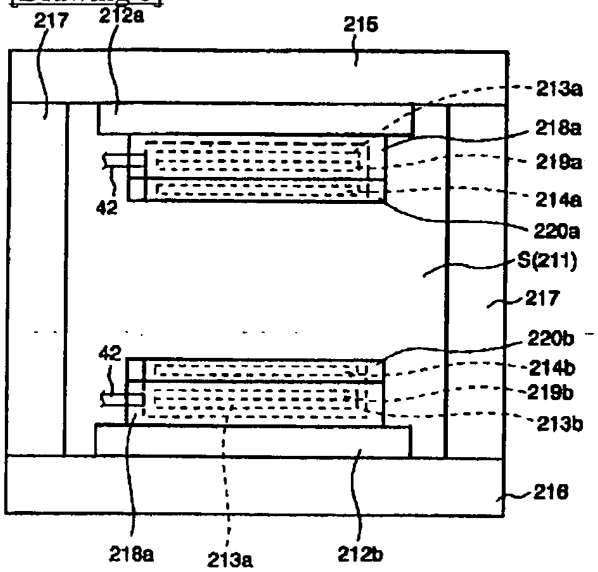
LTB

プロトコルNo.	被検部位	冷却能力
1	頭部	0.7
2	頸部	0.6
3	胸部	0.8
⋮		
m	腹部	0.85

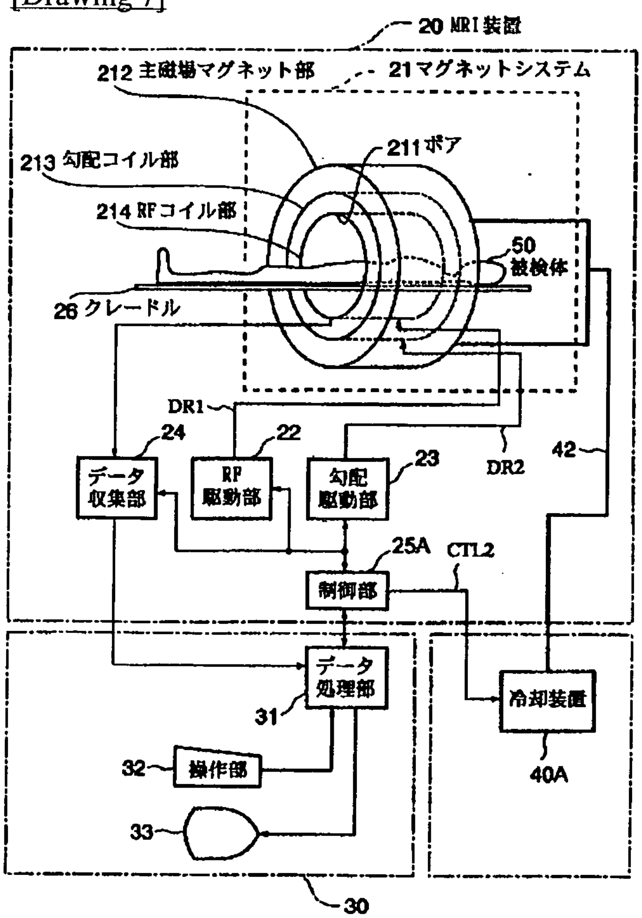
[Drawing 6]



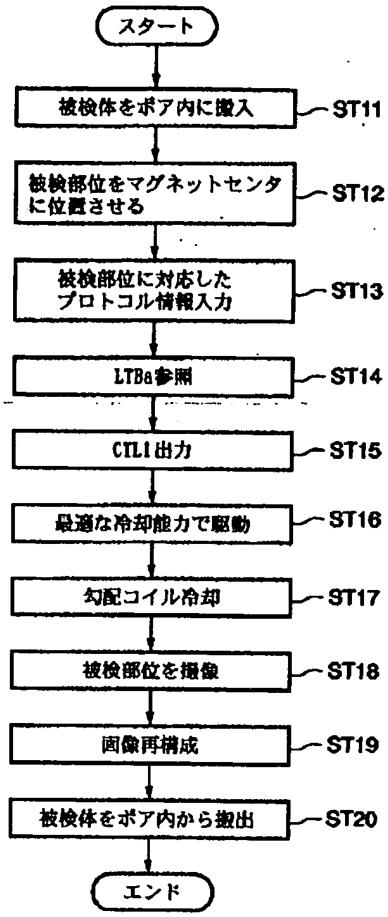
[Drawing 8]



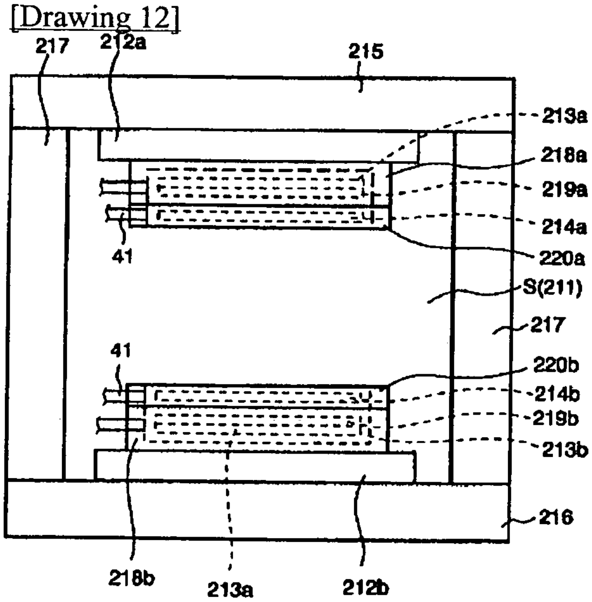
[Drawing 7]



[Drawing 10]



[Drawing 12]



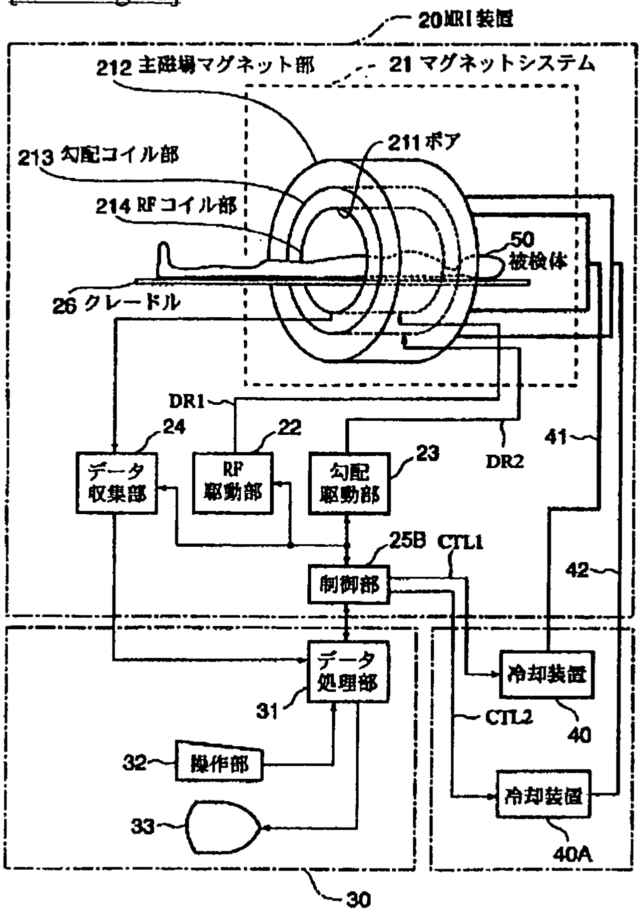
[Drawing 13]

251b

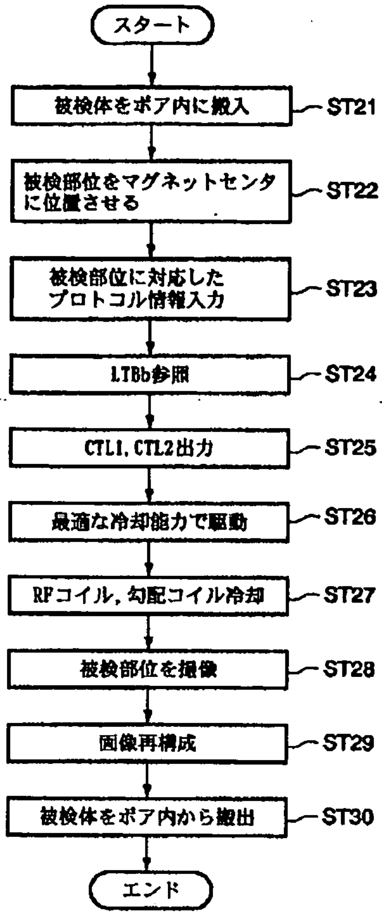
LTBb

プロトコルNo.	被検部位	冷却能力1	冷却能力2
1	頭部	0.7	0.7
2	頸部	0.6	0.6
3	胸部	0.8	0.85
⋮			
m	腹部	0.85	0.90

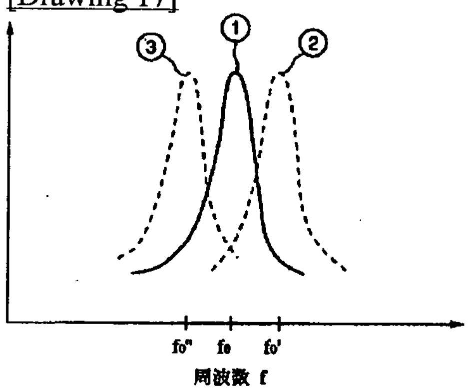
[Drawing 11]



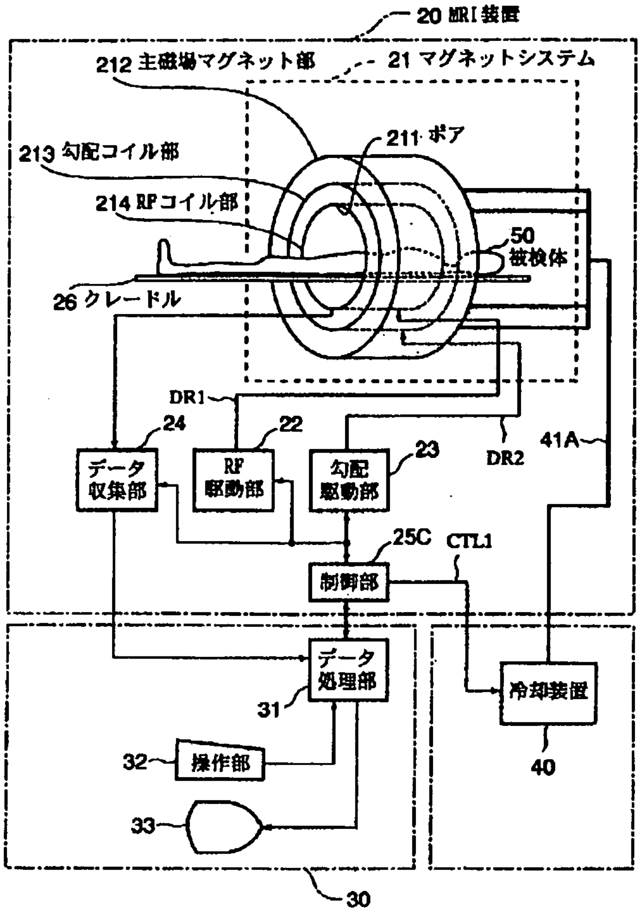
[Drawing 14]



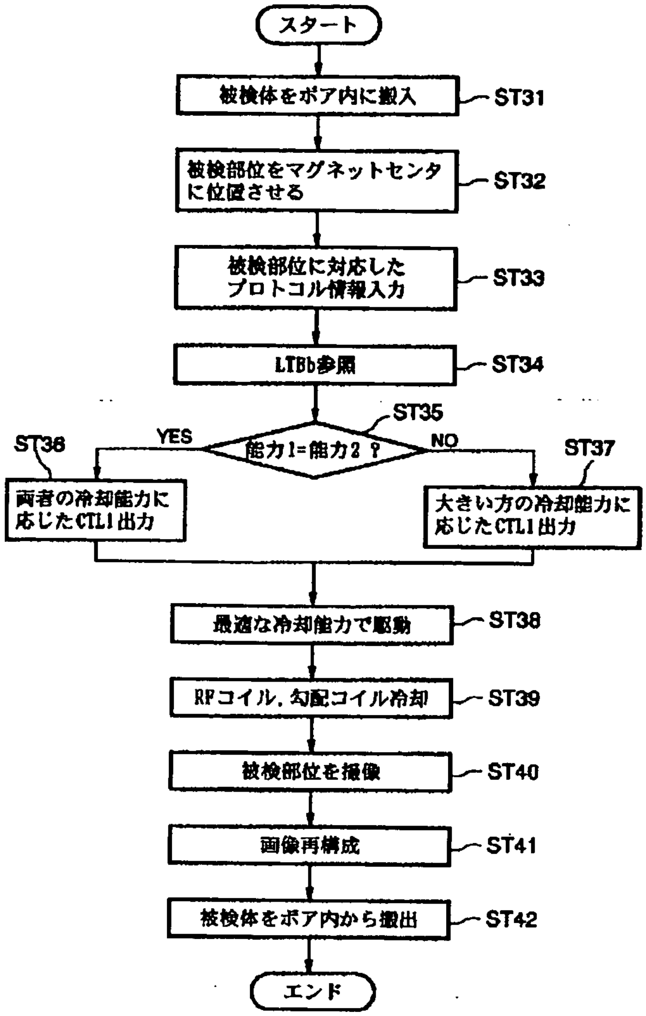
[Drawing 17]



[Drawing 15]


20 MRI装置
212 主磁場マグネット部
21 マグネットシステム
211 ボア
213 勾配コイル部
214 RFコイル部
50 被検体
26 クレードル
DR1
DR2
41A
24
22
23
データ収集部
RF駆動部
勾配駆動部
25C
CTL1
制御部
データ処理部
冷却装置
31
32
操作部
33
40
30

[Drawing 16]



[Translation done.]